CLAIMS

1. A grating, suitable for filtering optical radiation, comprising a plurality of concatenated grating sections, physical characteristics of each section differing from physical characteristics of each adjacent section thereby defining a transition therebetween, at least some of the sections each comprising a waveguide structure formed by a thin strip (100) of a material having a relatively high free charge carrier density surrounded by material having a relatively low free charge carrier density, the strip having finite width (W) and thickness (t) with dimensions such that optical radiation having a wavelength in a predetermined range couples to the strip and propagates along the length of the strip as a plasmon-polariton wave, said wave being partially reflected at the transition between said waveguide structure and the following said adjacent section, the arrangement being such that reflections at the different said transitions along said grating add constructively.

2. A grating according to claim 1, wherein said grating sections are arranged in cells each comprising a pair of adjacent grating sections, the cells being identical.

3. A grating according to claim 1, wherein grating sections are arranged in cells each comprising a pair of adjacent grating sections, the grating being non-uniform.

4. A grating according to claim 3, wherein the cells of the grating vary along its length in a chirped manner.

5. A grating according to claim 4, wherein the chirping is linear.

6. A grating according to claim 4, wherein the chirping is non-linear.

7. A grating according to claim 1, wherein the grating comprises at least two interleaved sets of cells, each cell comprising a pair of adjacent grating sections.

8. A grating according to claim 1, wherein the grating comprises a plurality of segments, each segment comprising a set of cells that are similar in size and shape, but the cells of each segment differing in shape and size from the cells of other segments, each cell comprising a

pair of adjacent grating sections.

9. A grating according to claim 1, wherein the grating comprises a series of cells, each cell comprising two grating sections, said series comprising a first set of cells (Λ_1, Λ_2, ... Λ_S) and a second set of cells (Λ_1', Λ_2', ... Λ_S'), the two sets of cells being different from each other and interleaved alternately cell by cell.

10. A grating according to claim 9, wherein the first set of cells is equivalent to the second set of cells transposed longitudinally.

11. A grating comprising a series of cells each cell comprising two grating sections, said series comprising a first set of cells (Λ_1, Λ_2, ... Λ_S) and a second set of cells (Λ_1', Λ_2', ... Λ_S'), the two sets of cells being different from each other and interleaved alternately cell by cell.

12. A grating according to claim 11, wherein the first set of cells is equivalent to the second set of cells transposed longitudinally.

13. A grating according to claim 1 or 11, wherein the strips in different grating sections are made of different material.

14. A grating according to claim 1 or 11, comprising two arrays of waveguide structures disposed adjacent each other and having said sections sized and shaped so as to form stop bands at desired locations in the optical spectrum.

15. A grating according to claim 14, wherein the array is two-dimensional.

16. A grating according to claim 14, wherein the array is three-dimensional.

17. A grating according to claim 1 or 11, wherein each strip has a substantially square cross-sectional shape.

18. A grating according to claim 1 or 11, wherein the grating sections vary such that an

effective refractive index profile of the grating is apodized.

19. A grating according to claim 18, wherein the apodization is sinusoidal.

20. A grating according to claim 1 or 11, further comprising adjusting means for modifying an optical response of the grating.

21. A grating according to claim 1 or 11, wherein the first and second grating sections each comprise a said strip and the plurality of strips are integral with each other.

22. A grating according to claim 21, further comprising adjusting means for modifying an optical response of the grating, the adjusting means comprising at least one electrode positioned near the grating structure and connected to one terminal of a voltage source, a second terminal of the voltage source being connected to at least one said strip.

23. A grating according to claim 21 or 22, wherein the first and second grating sections have different widths.

24. A grating according to claim 21, 22 or 23, wherein said strips are other than rectangular in shape.

25. A grating according to claim 24, wherein each said cell comprises two trapezoidal strips with their broader edges juxtaposed.

26 A grating according to claim 1 or 11, wherein the first and second sections comprise first and second strips, respectively, of different material.

27. A grating according to claim 1 or 11, wherein the grating sections comprise a series of said waveguide structures and a corresponding series of spaces alternating with said waveguide structures.

28. A grating according to claim 27, further comprising adjusting means for modifying an optical response of the grating, the adjusting means comprising a voltage source for

providing a potential difference between the strips of alternate ones of the series of waveguide structures and the strips of intervening ones of the waveguide structures.

29. A grating according to claim 28, wherein the material between the sections is an electro-optic material and the voltage source provides a potential gradient therein.

30. A grating according to claim 28 or 29, wherein the spaces are filled with said surrounding material.

31. A grating according to claim 28 or 29, wherein the spaces are filled with a material that is not the same as said surrounding material.

32. A method of producing a grating suitable for filtering optical radiation within a specified range of wavelengths and formed from waveguide strip surrounded by a dielectric material, the method comprising the steps of:

(i) using a numerical analysis method, deriving for said specified wavelengths, a waveguide strip of a particular material, and a particular surrounding dielectric material, normalized phase constant (β/β_0) and normalized attenuation constant (α/β_0) for a particular waveguide strip thickness and each of several waveguide widths, or for a particular waveguide width and for each of a plurality of waveguide thicknesses;

(ii) determining a particular structure for the grating as comprising a series of strips having a predetermined overall length, adjacent strips in the series having different widths, or a series of strips all having the same width and with spaces between adjacent ones of the strips, or a series of strips having spaces between adjacent strips, alternate strips having different widths, and selecting for each of said strips a particular length;

(iii) using the normalized phase constants and normalized attenuation constants derived in step (i), obtaining the complex effective refractive index ($\tilde{n}_{eff} = \beta/\beta_0 - j\alpha/\beta_0$) of the main mode supported by each of said strips in said series;

(iv) constructing an equivalent stack of dielectric slabs, each slab taking on the complex effective refractive index of the corresponding strip in said series of strips; and

(v) deriving the optical response of the equivalent stack.

33. A method according to claim 32, wherein the optical response is derived using a transfer

matrix method or coupled mode theory.

34. A method according to claim 32, for a uniform grating, wherein the optical response is derived using the Bloch theorem.

35. A method according to claim 32, 33 or 34, wherein the numerical analysis method is selected from the Method of Lines, the Finite Element Method and the Finite Difference Method.